TRANSIT ADVISORY TASK FORCE

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December 14, 2006

TO: Romy Cachola, Chair, Council Committee on Transportation and Planning

CC: Donovan Dela Cruz, Council Chair
Transit Advisory Task Force members

Kazu Hayashida

FROM: Kazu Hayashida, Chair, Council Transit Advisory Task Force

SUBJECT: Transit Advisory Task Force Report

Following is the report of the Transit Advisory Task Force called for in Council Resolution 06-292, CD1, "Establishing A Transit Advisory Task Force To Assist The Council In Selecting The Locally Preferred Alternative For The City And County Of Honolulu."

The above-referenced Council resolution asked the Task Force to make findings and recommendations in three areas:

1. Whether each alternative in the AA is presented fairly and accurately.

2. Whether the AA's forecast of ridership, impacts, costs and financing for each alternative is reasonable, whether the data provided is comparable to historical data from operating systems in other jurisdictions, and whether the alternatives can be fairly compared on the basis of those forecasts.

3. Whether any additional information must be obtained to enable the Council to select a Locally Preferred Alternative, and if so, where and how such information can be expeditiously obtained.

The Task Force established several committees to review specific aspects of the Alternatives Analysis:

- Committee to review modeling methodologies and the ridership and travel time forecasts they produced.

- Committee to review construction cost estimates to ascertain whether they were reasonably compiled and prepared consistently for all alternatives involving construction.

- Committee to review financing of proposed alternatives involving construction.

Misc. Com. No. 1854

These committees have prepared reports presenting their findings, which are included in Appendix 1.[1] In addition, the Task Force's transit analyst addressed other issues as requested by the Task Force Chair.

1. Whether each alternative in the AA is presented fairly and accurately.

The Alternatives Analysis ("AA") proposed four alternatives – No Build, Transportation System Management (improvements not involving capital expenditures), Managed Lane, and Fixed Guideway. We conclude that these alternatives were fully and fairly presented. The Task Force focused its review on the two alternatives involving construction (Managed Lane, Fixed Guideway).

Presentation of the Managed Lane Alternative (Alternative No. 3). The Managed Lane Alternative mirrors a proposal submitted to the City Department of Transportation Services (DTS) Administration by a member of the public approximately 1 year ago, in response to invitations to the public to come up with alternatives to a fixed guideway system. (The primary differences are that the DTS Managed Lane Alternative has added an off ramp at the stadium, and a station near Middle Street.) The Task Force finds that the Alternatives Analysis' presentation and assessment of this alternative were fair and accurate, however, it may well be that operational variations of this alternative could make it more attractive and/or feasible than the specific version considered. These variations are discussed under question no. 3 below (additional information).

Use of "rail" as a shorthand for the Fixed Guideway Alternative. The Fixed Guideway Alternative has been regularly referred to as the "rail" alternative. The Alternatives Analysis did not specify the transit technology (e.g., light rail, heavy rail, bus rapid transit, personal rapid transit) to be operated on Alternative No. 4's fixed guideway. Rather, it states that the choice of technology will be made at a later stage in the planning process.[2]

2. Whether the AA's forecast of ridership, impacts, costs and financing for each alternative is reasonable, whether the data provided is comparable to historical data from operating systems in other jurisdictions, and whether the alternatives can be fairly compared on the basis of those forecasts.

Ridership forecasts. Each of the members (2) of the Committee charged to review the Alternatives Analysis' ridership forecasts independently prepared a report presenting the results of his review. Professor Karl Kim, Ph.D., Professor and Chair, Urban & Regional Planning, University of Hawaii at Manoa, reviewed the planning methods, sources of data, and the internal workings of the computer model used to produce ridership estimates, and concluded that the model produced useful information that could reasonably be relied on for the planning purposes of the Alternatives Analysis. Professor Panos Prevedouros, Ph.D., Professor of Transportation Engineering, Department of Civil and Environmental Engineering, University of Hawaii at Manoa, reviewed the model's outputs, as presented in the Alternatives Analysis, and questioned specific results that in his view call into question the model's predictions for these same planning purposes. Both Professors' reports are included in Appendix 1.

The Task Force's transit analyst checked with DOT/Federal Transit Administration ("FTA") staff in Washington to ascertain FTA's familiarity and "comfort level" with the ridership forecasting model being used here.[3] The Honolulu planning model does not suffer from deficiencies that FTA has identified in other transportation ridership forecasting models in current use.[4] Nevertheless, FTA will be reviewing the operation of the model and its outputs in detail over the next few months in anticipation of the City's application for entry into New Starts Preliminary Engineering. This review will include testing of the model to ascertain how well its outputs compare with the on-board survey results, as well as how well it reproduces observed travel and ridership patterns.

The Task Force cannot resolve the disagreements between these Task Force members/professors. Professor Kim concludes that the model reflects a sound, "best practices" approach that produces useful, consistent results that enable evaluation and comparison of alternatives. Although Professor Prevedouros is critical of specific results produced by the Honolulu planning model, he does not disagree with the use of computer models for transportation planning. We appreciate that FTA has no a priori dissatisfaction with the computer model being used for this project, and welcome FTA's thorough review and testing of this model and the results it produces. If any of the questions posed by Professor Prevedouros in fact raise substantive issues with the model, we would expect the FTA's review to flag them. We note that, with respect to the model's projections that are based on population trends, the population data used in the model are generated by the State, and must be accepted for transportation planning purposes. We conclude that the ridership and related forecasts presented in the Alternatives Analysis provide a reasonable basis for describing the impacts of each Alternative, and for comparing these Alternatives.

Construction Costs. The Task Force's committee charged with reviewing cost estimates for the two Alternatives involving construction (Managed Lane Alternative and Fixed Guideway Alternative) concluded that the capital costs for each were compiled using the same FTA-prescribed methodology and common unit cost prices. These unit prices (price per cubic yard of concrete, per ton of reinforcing steel, etc.) were obtained from recent large construction projects on Oahu (Waimalu section of the H-1 highway viaduct widening) and validated against U.S. Navy construction unit cost data. Both Alternatives are designed to AASHTO design standards. The committee also compared cost per square foot estimates for construction of the Alternatives' elevated (bridge) structures ($330 per square foot, and $390 per square foot for construction in urban areas) against the Hawaii State DOT's current planning cost estimate for elevated structures -- $400-$500 per square foot. The Task Force agrees with this committee that the Alternatives Analysis' construction cost estimates were fairly and consistently prepared, and that they may be used for both planning and cost comparisons.

Because of the attention focused on comparison of the Alternatives Analysis' estimates of construction costs versus actual costs to construct a partially elevated tollway in Tampa, Florida, the Task Force requested the committee to assess whether the two projects are comparable. The committee concluded that the projects are sufficiently different (actual costs versus projected costs with contingencies; available, accessible ROW vs. construction in actively used highways; no utilities relocation vs. extensive relocations) as to make the comparison unreasonable.

This committee noted the significance of the proposed location of the Fixed Guideway Alternative's maintenance/vehicle storage facility at the Navy Drum Storage site (blue shaded area Makai of Farrington Highway in AA, figure 2-4 on p. 2 - 10). By treating the need to connect the fixed guideway to this particular site as mandatory, flexibility may be lost to extend the fixed guideway in the Koko Head direction, or to construct this Alternative in otherwise logical segments. The Task Force recommends that a renewed effort to find an alternative site for the maintenance/vehicle storage facility that is closer to downtown, so that the planning for this Alternative is not unnecessarily constrained.

Financing. This committee reviewed the methodology developed to calculate GET ½% tax surcharge revenues and concluded that it produced a reasonable range of tax revenue estimates. The possibility that taxpayers will "game" the tax scheme (by reallocating taxable income to other islands) is real, and the Task Force recommends that the Council develop a plan for addressing it.

Federal funding request. The Federal New Starts funding being budgeted for in the Alternatives Analysis ($930-950 million) exceeds the amount FTA gives to most projects ($750 million). We note, however, that the amount being sought is 20-25% of total costs, depending on the funding obtained from the GET ½% surcharge. This percentage is a smaller share of total project cost than FTA usually provides, and has been cited by FTA as justification for a Federal contribution exceeding the usual amount. In view of FTA's informal advice to ask for what is really needed, we conclude that it is reasonable to use the AA's proposed Federal contribution for planning purposes.

3. Whether any additional information must be obtained to enable the Council to select a Locally Preferred Alternative, and if so, where and how such information can be expeditiously obtained.

The Task Force did not identify any additional information that the Council must obtain before proceeding. However, as observed above, the Alternatives Analysis should have presented variations on the Managed Lane Alternative that could make this alternative more attractive. Appendix 3 contains suggestions for fleshing out possible variants of the Managed Lane Alternative.

A witness at the City Council's hearing held December 7, 2006, testified to limitations on electric generating capabilities on Oahu that could adversely affect operation of electric-powered vehicles on a fixed guideway transit system. When this concern was raised with DTS Administration, the response was that Hawaiian Electric Co. has assured that it can meet a fixed guideway transit system's power requirements. The Task Force recommends that this issue be explored in more detail, perhaps within the NEPA process.

Environmental Review Status. Council members have questioned why the Alternatives Analysis Report was not accompanied by a Draft Environmental Impact Statement (DEIS) presenting information as to the environmental consequences of the alternatives described in the Report. Early on in the preparation of the Alternatives Analysis, it was the Department of Transportation Services (DTS) Administration's intention to prepare the Alternatives Analysis and a draft Environmental Impact Statement at the same time.[5] The Task Force and the Council have recently been informed that the DTS Administration now plans to conduct the Federal environmental review (NEPA) process after the selection of the Locally Preferred Alternative.[6] This process will begin with "scoping," which involves the identification of alternatives to be studied in the environmental review. This procedure for meeting NEPA requirements is permitted by FTA guidance,[7] however, FTA requires completion of the scoping process prior to a project's entry into Preliminary Engineering.

By proceeding in this order, the DTS Administration expects that scoping's identification of alternatives will be limited to those that are responsive to specific environmental issues posed by the selected Locally Preferred Alternative. The scoping process could elicit proposals that are alternatives to the LPA itself, however, including an alternative that was considered and rejected when the LPA was chosen. In this event, if the Federal Transit Administration is not persuaded that elimination of that alternative was reasonable, it may be necessary to include that alternative in the environmental review process.

Finalization of OMPO's regional transportation plan. The Oahu Metropolitan Planning Organization's (OMPO) projection of worsening traffic congestion provides the formal impetus for the preparation of the Alternatives Analysis. Its predictions appear in OMPO's draft regional transportation plan. The Council should assure that the final version of OMPO's regional transportation plan is substantively unchanged from the draft version being relied upon.[8]

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[1] Each committee presented a summary of its draft report to the Task Force, and responded to questions from Task Force members. The public also had opportunity to comment on these presentations. However, due to the limited time available, the members of each committee may not have had opportunity to evaluate in depth the reports prepared by the other committees.

[2] "The system could use any of a range of fixed-guideway transit technologies that meet performance requirements and could be either automated or employ drivers." AA, p. 2 - 7.

Vehicle performance assumptions: vehicle loading – one standee per 2.7 sq. ft. of floor space; multi-car trains (two vehicles per train), each train is 175-200 ft long and capable of carrying 300 passengers). AA, p. 2 - 15.

> "A broad range of technologies was considered for application to this alternative [Alternative 4: Fixed Guideway], including light rail transit, personal rapid transit, automated people mover, monorail, magnetic levitation (maglev), commuter rail, and emerging technologies that are still in the development stage. Through a

screening process, seven transit technologies were selected and will be considered as possible options. Those seven potential technologies include: conventional bus, guided bus, light rail, people mover, monorail, maglev and rapid rail. Technologies that were not carried forward from a screening process include personal rapid transit, commuter rail, and the emerging technologies. The technology screening process and results are documented in the *Honolulu High-Capacity Transit Corridor Project Technology Options Memo.*"
Alternatives Analysis Detailed Definition of Alternatives, p. 6 - 1 (Nov. 1, 2006).

[3] The transit analyst spoke with an FTA staff member who was indeed familiar with the Oahu transportation planning model -- he oversaw its initial development in the mid-'90's while working as a contractor employee prior to joining FTA.

[4] The FTA staff member referred to a technical discussion of these computer model deficiencies at a recent (June 2006) FTA-sponsored workshop that reviewed current issues in transportation planning methodology. Materials from this workshop appear at the FTA website. Attached is a discussion paper resulting from this workshop that reviews the history of New Starts transit ridership projections produced by computer planning models. See Appendix 2.

[5] "Scoping Report: Honolulu High-Capacity Transit Corridor Project," at p. 3 -1 (April 6, 2006).

[6] In the course of the Task Force's discussion of a draft of this report, a Task Force member indicated that the approach to accomplishing Federal NEPA environmental review that the DTS Administration now plans is similar to the State's environmental review procedure under Ch. 343, which encourages environmental review after an agency's proposed action has been defined. Section 343-5(f) of this chapter encourages cooperation among Federal and State agencies when both a State EIS and a NEPA EIS are required for the same project, including preparation of a single EIS document that meets both State and Federal requirements.

[7] In a letter to Councilmember Cachola, Chair, Transportation and Planning Committee, dated November 22, 2006 (#D-0958), DTS Director Kaku stated --

> "... the Administration was poised to prepare the AA and DEIS as a single document (AA/DEIS). An AA/DEIS follows FDA's traditional approach for preparing the programmatic environmental analyses and documentation. Beginning in 1993, FTA began to allow for the completion of an AA prior to the preparation of a DEIS as another option. Therefore, in accordance with Council Resolution 05 -- 377, CD1, the Administration has been following the latter option approved by FTA, whereby the AA required by 49 U.S.C. Section 5309(d) is conducted as a planning study prior to the National Environmental Policy Act review.
>
> "An EIS document is now scheduled to be prepared concurrent with the progress of preliminary engineering efforts once the LPA has been determined."

Guidance recently issued by the FTA discussing the relationship between the Alternatives Analysis and the NEPA environmental review process authorizes compliance with the environmental review process after completion of an Alternatives Analysis. From this guidance, summarized below, it appears that the entire environmental process may be conducted after the Alternatives Analysis, including the scoping phase. (Scoping is required by the NEPA process to identify the range of alternatives to be addressed in the DEIS.) However, with respect to scoping, "FTA requires projects to have progressed beyond the NEPA scoping phase before it will approve entry into New Starts preliminary engineering." The DEIS may then be prepared as part of preliminary engineering. "FTA recognizes that when the Draft EIS is being prepared as part of the New Starts PE [Preliminary Engineering] process, the scoping process can take 3 to 4 months to complete. Project sponsors should build this step into the schedule, recognizing that scoping can occur while FTA is reviewing the ridership, cost, and financial information that support the request to enter into New Starts PE." Federal Transit Administration, "Guidance on New Starts Policies and Procedures," p. 5 (May 16, 2006).)

DTS Chief Planner Toru Hamayasu has confirmed that it is now the DTS Administration's plan to prepare a DEIS after the Locally Preferred Alternative is selected, and that a new scoping process will first be conducted to support that DEIS effort. The DEIS will then be prepared (for submission to and eventual issuance by FTA) based on the result of that scoping report.

FTA's guidance states:

> "Performing the New Starts planning Alternatives Analysis prior to the environmental review process (so-called "Option 1") is most effective when the study area has complex transportation issues and a myriad of potential solutions, including alternative transportation modes, transit technologies, and alignments, and combinations thereof. In this case, a planning study to focus the issues is appropriate before initiating the environmental review process."

This guidance goes on to state that,

> "...for the results of a planning study (including a New Starts planning Alternatives Analysis) to be carried forward into the environmental review process, those results must be subjected to public and interagency review and comment during the scoping of the EIS, among other requirements."

Federal Transit Administration, "Notice of Availability of Guidance on Section 6002 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)," response to Question 13, 71 Fed. Reg. 66576 (November 15, 2006).

[8] In a planning context, the Alternatives Analysis represents a governmental response to the O'ahu Metropolitan Planning Organization's (OMPO) projection of worsening traffic congestion in the Kapolei – University of Hawaii-Manoa corridor. Alternatives Analysis, pp. S-1 – S-2. These projections are presented in OMPO's draft "O'ahu Regional Transportation Plan (ORTP) 2030." This draft was approved by OMPO's Policy Committee on April 4, 2006, however, it has not been finalized or officially released. A notice has recently been placed on the OMPO web site stating: "The Oahu Regional Transportation Plan is being finalized; a final document is expected by the end of 2006."

APPENDICES

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List of Appendices

Appendix 1 -- Committee Reports
Ridership & Modeling Committee (two reports)
Construction Costs Committee report
Financing Committee report

Appendix 2 -- FTA Discussion Paper #6, "Predicted and Actual Ridership of Proposed New Starts Projects," Federal Transit Administration (June 6, 2006). Also available at: http://www.fta.dot.gov/planning/newstarts/planning_environment_5402.html

Appendix 3 -- Suggestions for further development of the Managed Lane Alternative.

Appendix 4 -- Questions the Task Force posed to DTS Administration, and the answers received.

Review of Alternatives Analysis
Ridership Forecasts

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Overview

Documents related to ridership estimates were reviewed, including the *Honolulu High-Capacity Transit Corridor Alternatives Analysis Report*, the draft Transit Forecasting Methodology Report, and *Travel Forecasting Model Development Project* of the Oahu Metropolitan Planning Organization, Final Documentation. A number of source documents such as the 2005 On-Board Bus Survey and other materials from the consultant were also reviewed. In addition telephone interviews were conducted with Mr. Toru Hamayasu (DTS), Mr. Gordon Lum (OMPO), and Mr. Mark Schiebe (PBQD).

The review was focused on three interrelated questions: 1) are the models and methods used sound? 2) do they produce useful information? and, 3) are the results accurate, reliable, valid? The review concludes with some summary comments.

Background

The Alternatives Analysis provides estimates for 2005 and 2030 for existing conditions, no-build,TSM, Managed Lane, and a number of Fixed Guideway alternatives. The ridership estimates are based on the OMPO regional travel demand model which was updated to estimate the effects of both existing conditions and the various alternatives. OMPO uses a "best practice" modeling approach whereby the components of the traditional four-step (trip generation, trip distribution, mode choice, network assignment) estimation procedure have tested and validated in other jurisdictions and then used in Honolulu. While there have been some new approaches to demand forecasting proposed in the literature, the emphasis with OMPO is to use industry-standard and FTA approved methods and approaches along with updated information. The number of trip assignment zones has been increased from 284 to 762. A new on-board bus survey was completed in 2005 which was used to validate the results of the ridership estimates. Some other enhancements to the OMPO model include the use of 11 different resident trip purpose (including 6 work-related trips) and a two stage trip distribution process to link trip productions to attractions and produce trip tables. The trip distribution procedure uses a Fratar, iterative fitting technique for balancing rows to equal productions and columns to equal attractions. The mode choice model utilizes a nested structure in which auto, transit, and non-motorized travel (walk/bike) are considered; as are options such as single vehicle occupant, 1- and 2- occupant auto, local and premium bus services as well as kiss-n-ride and park-n-ride facilities. In addition to the estimation of ridership, travel times by mode and class and type of service are also provided. The FTA SUMMIT package also generates zone-to-zone estimates of ridership and travel benefits and impacts.

Soundness of Methods

After reviewing the various documents and speaking to many of the principals involved, I am convinced that the general approach – that is, using a version of the traditional four-step process, using the same model that was developed for the metropolitan planning organization (OMPO), and following FTA's guidelines and recommended procedures is not only sound, it provides opportunity to take advantage of work done over the years for Oahu as well as to incorporate ideas and knowledge from other jurisdictions. The "best practice" approach may not necessarily lead to the most innovative, or advanced or latest theoretical developments in ridership forecasting, but it does enable the City to build on widely accepted, tested, and used approaches to ridership forecasting. The other advantage is that it enables a degree of peer-review to occur, not just because the OMPO models have been developed and tested and reviewed and vetted over a 10 year period, but also because FTA has reviewed and accepted both the model form and the use of various parameters and functions used in the modeling process.

There has been discussion as to whether or not the traditional four-step, "comprehensive" approach should have been used. It is the industry standard. It is what is currently taught as the approach to take in urban transportation planning courses. The advantage is that the pieces of the model can be disentangled – from the land use and population projections, to auto ownership, to the generation of trip (work, school, recreational, etc.), to the distribution of trips in terms of origins and destinations and in terms of production and attraction zones, to the modal split (between transit and private automobile) including various nested combinations (park-n-ride, kiss-n-ride, bus-to-rail, etc.), as well as non-motorized modes (walk and bike). While the approach is complicated and multi-faceted, the value of it is that it lets us review, systematically, the various assumptions, data, forecasts, and inputs into the model and it allows us to understand both the overall ridership estimates as well as the regional, neighborhood, and eventually station location effects. While there have been some general criticisms of the large-scale comprehensive modeling it is, fundamentally, a sound approach to ridership estimation.

There have been some notable improvements made to the forecasting procedures used in Honolulu. The number of transportation analysis zones (TAZs) has been greatly increased. The kinds of different trip purposes has also been augmented. There have been continued developments in the trip distribution procedures. The model uses a Fratar approach which provides a form of internal consistency and validation, as the trip tables must balance. It is the recommended approach for the trip distribution component of the model. It should also be noted that there have been improvements in the mode choice part of the estimation procedure. A nested logit multinomial model is generally acknowledged as the preferred approach. While we are somewhat constrained by the choice of nests and the particular ordering, it does provide a superior approach to considering different travel modes in a more sequential fashion than a more "flattened" polynomial mode choice.

While one could nit-pick or quibble over the functional forms, model coefficients, and utilities contained in the model, from my perspective, the general approach taken is sound. While there are always opportunities to improve travel demand forecasting, it is also critical that reviewers understand and accept the fundamental differences between an approach which uses industry standard best practices for estimating overall travel demand by alternative versus a more limited partial picture of one or more aspects of transit ridership.

Does the Travel Demand Model Provide Useful Information?

While one can also ask for more detailed information about a particular travel mode or class of service, or the impacts on an individual neighborhood, the advantage of the large scale modeling approach is that it enables us to review system-wide effects and to compare the choices of no-build, TSM, managed lanes, and fixed rail alternatives. The disadvantage of this approach, however, is the problem of information overload or sorting out the most useful and important elements for evaluation and decision-making. It should be noted, however, that the Alternative Analysis provides useful information on: 1) the total number of transit trips for each of the different alternatives including fixed rail estimates; 2) the estimated fixed rail boardings for proposed stations; 3) total VMT (vehicle miles traveled), VHT (vehicle hours traveled), and hours of delay for each of the alternatives; and 4) peak hour volumes and LOS (level of service) estimates for screenlines by alternative.

These systemwide measures are useful in a number of ways. They provide an estimate of automobile use versus other modes of travel. The VMT and VHT measures show auto use both in terms of miles and in terms of hours spent on the road. The vehicle hours of delay is a measure of congestion as are the estimates of LOS. There are two kinds of information provided in the Alternatives Analysis report: 1) information about future travel patterns and demand; and 2) information which allows for the comparison of alternatives.

Looking into the future is a difficult, challenging activity. Such is the business of planning. Part of the difficulty arises from the diversity of factors that can affect the forecasts of population, employment, and other activities of travel demand. The model predicts growth in travel demand and in transit trips even under the "no-builld" assumption. The Alternatives Analysis compares the increase in transit trips over the number of transit trips forecast under the "no-build" alternative. While different alignments and configurations for the fixed guideway alternative are presented, it is also important to note the Alternatives Analysis enables comparison amongst the alternatives. This is the essence of an alternatives analysis.

Were the alternatives correctly specified? The framework of comparison – existing conditions, "no-build," TSM (Transportation Systems Management), Managed Lane, and Fixed Guideway (four different alignments) is appropriate and reasonable. It should be noted that the bus fleet size used in the analysis grows from 525 (existing) to 614 (no-build) to 765 (TSM) to 846/906 (two direction/reversible managed lane) options. The bus fleet is held closer to existing levels under the guideway alternatives.

It is also important to note that under the Managed Lane alternatives, various estimates of the effects of tolls were determined. Using a modeling approach developed for Houston and constraining the LOS to "C" (1,400 vehicles per hour) or "D" service (1,760 vehicles per hour) which would require a toll of $6.40 on all single and double occupant vehicles (all 3+ occupant vehicles would be free), the effects of tolls were also considered. It is important to note that this alternative is also studied in the OMPO model.

Accuracy, Reliability, and Validity

With travel demand estimation, the accuracy (or correctness) of the results can only ultimately be demonstrated after the system has been built and data collected in 2030. The issue of reliability refers to the reproducibility of the results. In part, this has been addressed in that the OMPO model was run in 2002 (albeit for different alternatives) and then re-run more recently for the High Capacity Transit Corridor Project. An initial inspection of the results indicates that there is a degree of consistency and reliability in terms of the model results. Certainly more information on the reliability of the estimates will become available as parts of the model are re-run as the project advances. Also, because the model is reviewed not just by OMPO and by the FTA, there are opportunities to investigate the reproducibility of the various estimates.

One of the advantages of using the large-scale travel demand forecasting procedure is that there are different ways of validating the results. More extensive documentation of the validation of the OMPO model is available. The validation consists of comparing the estimated to observed travel times for different classes or types of travel for a base year. Typically, an on-board bus survey is done to get ridership and travel time estimates as well data on origins and destinations. These data are compared to modeled or estimated results. A regression model comparing estimated to observed values is calculated, with the R-squared value used as measure of the explanatory or predictive power of the model. While there is need for more documentation of the validation effort for the High Capacity Corridor project, if the estimated travel times and boardings are within a reasonable range of the observed 2005 on-board survey results, then the confidence in the estimates will be increased.

More effort could go towards the documentation of the modeling procedure. At issue are concerns regarding the aggregation of effects – from the 762 zones to the corridor and the other reporting districts contained in the Alternatives Analysis. There was not sufficient time to do a full audit of the model, nor was there adequate opportunity to examine how the different components from resident based trips to visitor trips and other details were integrated. It is assumed that because these are elements common to the OMPO model and because FTA reviews these details, these aspects of the model can be verified and documented at some later point.

Summary Comments

The methods used in the ridership estimates appear to be sound. The basic structure and approach to ridership modeling, meet industry standards consistent with the "best practice" approach employed by OMPO. It is also somewhat reassuring that the same model which is used by OMPO is also used in the Honolulu High Capacity Transit Corridor Project. The use of the traditional four-step demand estimation procedure with a Fratar trip distribution procedure and a nested logit model is comparable to what is done in other jurisdictions. While there is need for more evaluation of some of the input data – that is information regarding the population estimates, employment growth, and patterns of development to 2030, and while there are always opportunities to improve the specific sub-model components regarding auto ownership, mode choice, induced travel demand, visitor and other special purpose trips, as well as estimates regarding travel preferences as well as the willingness to pay for different types of transportation services, the general approach and set of procedures utilized in estimating ridership are sound.

The Alternatives Analysis provides useful information regarding travel demand, transit use (both presently and into the future), and a basis for comparison of alternatives in terms of key indicators related to transportation such as VMT, VHT, hours of delay, and LOS associated with the baseline, no-build, TSM, managed lane, and fixed guideway alternatives. While additional information could have been provided in terms of other benefits associated with increased choice of travel modes, increased reliability of travel from one point to another, and the differential impact of increased mobility and accessibility for various groups, allowing for more closer inspection of transportation equity and environmental justice requirements of each of the alternatives, these are concerns that might also be addressed in the environmental impact assessment procedure.

The Alternatives Analysis is a fairly digestable document. Unlike others which take hundreds of pages of text, this one seems fairly concise and focused on key issues, concerns, and impacts. As such it provides an adequate base of information on which to make a policy decision as to whether or not to proceed to the next stage of planning and preliminary engineering

A final comment is that the travel demand estimation procedures and the ridership estimates appear to be somewhat conservative. First, it is important to note that the "best practice" approach employed in this study will yield more reliable results since the techniques are used and tested and evaluated in many other jurisdictions. Second, because the model is reviewed by the FTA, the parameters, utilities, and estimates are constrained by federal guidelines. Third, modest assumptions regarding the cost of gasoline or automobile travel are utilized. They are predicted to grow no faster than the general rate of inflation. Fourth, assumptions regarding future development around stations and the increased ridership associated with transit oriented development or transit adjacent development were quite modest. For purposes of comparison across the various alternatives, the same pattern of land use and population growth and development was used. There has been much research to the contrary, that a fixed guideway system will in fact result in increased densities, resulting in lower automobile use and greater transit ridership. Finally, the utility functions used to specify the willingness to travel by various transportation modes are assumed to remain constant over the period. This is to suggest that people in 2030 will behave much as they do today. The willingness to take a fixed rail guideway system is ultimately based on the willingness of people today to use bus service. This is a conservative approach. The modest growth in transit ridership results from the improvements in transportation services vis-à-vis the various alternatives and alignment choices with constant preferences and utility functions.

While there is always room for improvement in the difficult task of travel demand forecasting, and while we must remain vigilant over the application of various forecasting techniques and the data used as inputs to the model, the ridership forecasts were done using sound methods, providing useful information that is reasonably accurate, reliable, and valid.

HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT:
ALTERNATIVES ANALYSIS (AA) REPORT - Report to Transit Task Force

Panos D. Prevedouros, Ph.D. - December 10, 2006
Member, Honolulu Transit Task Force, and Professor of Transportation Engineering, Department of Civil and Environmental Engineering, University of Hawaii at Manoa

This paper reviews the Alternatives Analysis report from an engineering perspective. In general, its organization tracks the organization of the report.

→ Page S-2: "Motorists experience substantial traffic congestion..." The report relies heavily on anecdotal experience of traffic congestion. It would benefit from a quantitative presentation of congestion data for major origin-destination pairs. This would allow for comparison of Honolulu's congestion to other cities. Data from the State's Congestion Management System should be cited and tabulated.

→ Page 1-1: The statements of purpose

- "improved mobility"
- "provide faster, more reliable public transportation services"
- "provide an alternative to private automobile travel"

make it clear that this is a public transit analysis - not a more comprehensive analysis of transportation issues in the subject corridor . In particular, the effects of the alternatives on freight transportation in the corridor are not considered, even though the alternatives will plainly impact freight. This Alternatives Analysis does not respond directly to the need to reduce traffic congestion on Oahu.

→ Page 1-1: Bottom: "Current a.m. peak period times for motorists from West Oahu to Downtown average between 45 and 81 minutes. By 2030, after including all of the planned roadway improvements in the ORTP, this travel time is projected to increase to between 53 and 83 minutes."

From this description, travel time will be relatively stable for 25 years into the future (45 minutes to 53 minutes, 81 minutes to 83 minutes, on average, provided the ORTP roadway improvements are implemented.) I question whether this level of inconvenience is severe enough to justify a fixed guideway project of the magnitude proposed in the Alternatives Analysis, in addition to the cost of the base improvements called for in the ORTP.

→ Page 1-9: The UH-Manoa campus is not identified here as a major public transit destination, notwithstanding the data presented on page 1-4 (20,000 students, 6,000 staff; 60% of students must drive or use transit to attend classes). If it is not a major transit destination, why is rail service to the UHM being considered?

Page 1-13, Table 1-1: The vehicle speed projection data presented here are not consistent with engineering observations. Once a street segment becomes saturated with traffic, such as the "Liliha Street" segment on the H-1 freeway, the average speed of vehicles on that segment tends to stabilize at about 15 mph. Therefore, the estimated average speed drop from 19 to 12 mph on the Liliha segment is unlikely. Rather, increased traffic will be experienced as longer periods of traffic congestion. The planning model does not seem to be able to model saturated traffic conditions correctly. This can affect speed estimates for congested roadways, and result in inaccurate travel time forecasts.

→ ♦ Page 2-3: Bus fleet size estimated for the Managed Lane alternative is overstated, and is not consistent with national experience. Buses run 10 miles in approximately 10 minutes on HOT lanes. As a result of improved bus efficiency, either fleet size is reduced, or a given fleet size can provide a much higher service frequency.

→ Page 2-16: It is not clear from the Operating and Maintenance cost estimates presented here whether replacement costs for the rolling stock and the multitude of deteriorating pieces of equipment (switches, generators, signals, computer controls, extensive wiring and power system, etc.) of the Rail option have been included in projections of annual O&M costs. Text at pages 3-9 and 3-10 do not answer this question.

→ Page 3-2: Table 3-1: Significant trip growth is projected in two out of 25 Traffic Analysis Areas on Oahu. Specifically:

Area 11 is Honouiliuli and Ewa Beach	2005 total daily trips are 176,000
	2030 total daily trips forecast at 342,000

This is an increase of 166,000 total daily trips.

Area 12 is Kapolei, Ko'Olina, Kalaeloa	2005 total daily trips are 122,000
	2030 total daily trips forecast at 362,000

This is an increase of 240,000 total daily trips.

Trip generation for these two areas will change from 298,000 trips in 2005 to 704,000 trips in 2030, a growth of 136% in 25 years. These estimates are questionable, given Oahu's population growth of 4.8% between 1990 and 2000, the annual growth in tourism of only 0.6% per annum since 1990, continued reduction in agriculture, stability in military operations and reduced travel as baby boomers retire and draw a pension instead of going to work.

For order-of-magnitude purposes, this 704,000 transit trip projection for areas 11 and 12 should be compared with the Table 3-3 estimates for transit trips under any of the four fixed guideway alternatives - 281,900 to 294,100 - for entire Oahu. If trips in areas 11 and 12 grow by only half as much, by 68% in 25 years, then their 352,000 projected new trips would be close to the projected total number of transit trips on Oahu.

→ Page 3-4: Data in Table 3-3 in combination with Table 3-7 also provide useful order-of-magnitude comparisons:

- Year 2030 Transit trips in the "No Build" alternative are projected at 232,100.
- Year 2030 Transit trips with the Rail alternative most favorable to transit are projected at 294,100.
- Total gain in transit trips after a rail system is constructed: 62,000 transit trips.
- Year 2030 Vehicle trips are estimated at about 3,000,000 (at a 1.6 average occupancy including buses, this estimate represents 4,800,000 person trips).
- The 62,000 new transit trips reflect about 1% of person trips.

Baseline transit trip projections have been historically overstated by about 21%, as the table below indicates. The table shows actual *TheBus* trips versus forecasted *TheBus* trips in the "No Build." In other words, the base ridership in the No Build is inflated. Once the base is inflated, all transit ridership forecasts are inflated and justifiably uncertain.

Millions of *TheBus* Transit Trips per Year

Year	Actual	Forecast	Source	Difference	% Error
1990	75.6				
1991	72.8				
1992	73.0				
1993	75.6				
1994	77.3				
1995	72.7				
1996	68.9				
1997	68.6				
1998	71.8				
1999	66.2				
2000	66.6				
2001	70.4	73.0	*HART*		
2002	73.5	67.0	*Hali 2000*		
2003	69.1	88.0	*Rail 1992*		
2004	61.3	104.0	*BRT 2001*		
2005	67.4	96.0	*Rail 2006*		
Average	**70.7**	**85.6**		**14.9**	**21.1%**

From Table 3-3 it can be observed that in 2030 the number of transit trips for the No Build Alternative is 232,100, and that the number of transit trips in the best rail option is 294,100. If the Rail's trip estimate is overstated by 21%, then 294,100 become 232,339; these are about equal to the transit trips in the No Build. Thus, all of the gain in transit trips due to a rail system may be attributable to the inflated baseline forecasts.

→ ♦ Pages 3-7, 3-8: The TSM alternative is estimated to have a requirement for 6,200 parking stalls at various park-and-ride facilities, the Managed Lane alternative has the same requirement, but the 20-mile rail option is projected to require only 5700 parking stalls. A smaller parking requirement for rail compared to TSM and ML does not make sense. In the Rail alternative many riders who cannot walk to a station must drive and therefore have to park their vehicles somewhere. In the TSM and ML alternatives, the transit vehicles - buses - collect riders from their residential neighborhoods and deliver them to their destination, thereby arguably reducing the quantity of parking stalls required. This discrepancy should be clarified.

→ Page 3-11: Table 3-11 includes travel time estimates for year 2030 with Rail. Basically travel by auto is <u>equal</u>, <u>faster</u> or <u>much faster</u> than rail for all 2030 trips between:

- Aiea (Pearlridge) and Downtown
- Downtown and Ala Moana Center
- Downtown and Manoa
- Airport and Waikiki

For trips between Aiea and either Waikiki or Manoa, all Rail alternatives will provide trip times that are the same as or longer than trips by auto. The travel times by auto reflect 2030 traffic congestion conditions without rail.

→Page 3-13: The following excerpts from the performance assessment of the Managed Lane Alternative indicate that the ML alternative did not receive minimal engineering analysis support needed to develop solutions to obvious issues:

> "While bus speeds on the managed lanes are projected to be relatively high, the H-1 freeway leading up to the managed lanes is projected to become more congested when compared with the other alternatives, because cars accessing the managed lanes would increase traffic volumes in those areas."

Instead of providing new ramps from the H-1 and H-2 freeways and a ramp from Farrington Hwy. to feed the Managed Lane facility, an already congested freeway itself was used to feed the ML. The predictable result is both more congestion on H-1 freeway and underutilization of the ML.

> "Additionally, significant congestion is anticipated to occur where the managed lanes connect to Nimitz Highway at Pacific Street near Downtown."

This occurred because a (poor) choice was made to simply use the state's proposed Nimitz Viaduct (NV) project. However, NV was conceived as a shortcut between the Keehi Interchange and downtown and was never intended to serve new traffic from the Ewa plains to town. It can still be used, but it needs to be re-engineered to provide adequate off ramps to major trip destinations. The AA's ML is under-engineered in terms of off and on ramps by a magnitude of at least three (3). Three times as many ramps are needed and can be engineered. If this is done, the quote below will have no place in the AA.

> "Hence, much of the time saved on the managed lane itself would be negated by the time spent in congestion leading up to the managed lane as well as exiting the lanes at their Downtown terminus."

Based on substantial evidence of ML being under-engineered, its performance statistics of are not representative of what a new 2-lane reversible expressway can do for this corridor.

In addition, the critical function of the ML as an escape/evacuation resource (or special event, high demand reliever) was not analyzed. The ML can be designed with Aloha Stadium and H-3 freeway as its middle anchor. In off-peak times, weekends, special events and evacuations, the ML can run from Waikele to Aloha Stadium and H-3 freeway on its west half, and from Iwilei to Aloha Stadium and H-3 freeway on its east half. Also, if Windward Oahu evacuation or high demand should occur, then the ML can be dynamically configured so that the H-3 freeway discharges both toward Ewa and toward Honolulu. In short, the ML provides extensive regional traffic management possibilities, none of which were explored.

→ ♦ Page 3-20: Table 3-10 presents projections of "vehicle hours traveled," a concept that has no application to trips using transit. This table should be reformulated to show "person *hours* of travel," to make the comparisons consistent and relevant. Based on my calculations (see Appendix 1), when these data are so converted, then the hours spent traveling on Oahu with a 20-mile Rail line will be 11% longer than the No Build. All Rail alternatives will provide worse Oahu-wide person hours of travel compared to the car and bus No Build alternative. This is consistent with past experience in the U.S. where new rail systems have not reduced traffic congestion.

→ ♦ Page 3-25. The traffic estimates for the Managed Lane alternative presented in Tables 3-12 and 3-13 appear to be based on the assumption that a freeway lane may not carry more than 1,400 vehicles per hour in order for it to operate at a good level of service. This is simply not U.S. national experience for priced lanes. For example, Appendix 2 provides a multi-week, year 2006 sample of a three-lane cross-section of California's SR-91 Managed Lanes. They operate at free flow (about 60 miles per hour) while carrying a volume of more than 2,000 vehicles per hour per lane. There is no reason why this result would not apply to a two-lane Managed Lane facility on Oahu. Based on multiple research projects I have conducted for the State of Hawaii DOT, there are several 15-minute periods during which lanes on the H-1 freeway carry over 2,400 vehicles per hour (hourly equivalent), which attests to the ability of local motorists to drive at headways necessary to result to lane capacities in excess of 2,000 vehicles per hour.

The tables in Appendix 3 provide a sample of traffic analysis, the conclusion of which is that in 2030 and with a properly designed 3-lane Managed Lane expressway, traffic congestion on the H-1 freeway will be almost the same as in 2003 while still using the AA's growth forecasts. Congestion on H-1 freeway will be incomparably worse with any of the Rail options.

→ Page 3-27: "The travel demand forecasting model has been reviewed and updated for use on the project." Following are several common-sense observations on the forecasting model:

- Oahu has no rail service, so the existing OMPO model (done with survey data which are over one decade old) naturally has no local parameters for any type of rail service. What parameters were introduced to the model to represent rail?
- Is the model representative of today's conditions? Since the OMPO model was developed, *TheBus'* share of total trips has declined in the last 10+ years, fuel costs went up in the last 10+ years, Kapolei employment was non-existent 10+ years ago, the "bust" real estate market of the early 1990s is "booming" now, the H-3 freeway did not exist 10+ years ago, safety and security issues in metro rail systems (Tokyo, London, Madrid) did not exist, and last but not least, a huge portion of Oahu's population, the baby boomers, were not on the verge of retirement. Given these circumstances, it is at least questionable whether any model based on historical data can provide useful predictions over the Alternatives Analysis' planning horizon, 2005-2030.

All these trends affect the setting of parameters and alternative-specific constants in the model. Given all these concerns, how can a fundamentally old mode choice model with "imported" parameters give any reasonable predictions for year 2030? The model should be provided for review and its parameters should be justified.

→ Page 3-28: "External factors, such as a downturn in the economy, could affect whether the island will develop as planned." The AA's forecast is truly a best case scenario which is an unrealistic basis for multibillion dollar civil infrastructure development. Below is a partial list of possible events that would make vigorous growth unlikely. For these reasons as well as the problematic construction and operation deployment of all Rail alternatives it is essential that Risk Assessment Analysis is part of this AA (see last point in this review.)

- practically zero growth in tourism
- a sustained energy crisis will cause high airfares and a reduction in tourist arrivals
- the possibility that avian flu, SARS or similar will further threaten tourism
- the Waikiki tourism plant is old, crowded and revitalization is slow
- continued reduction in agriculture
- stability in military operations and post-Iraq military downsizing to repay the war debt
- baby boomers retiring in large numbers
- substantial loss of seniority in Hawaii's Congressional Delegation will cause a dramatic decrease in earmarked projects and funds for Hawaii

Any of these reasons can cause a substantial reduction in development or expansion which makes rail an alternative that is inferior even to the simple TSM alternative.

→ Page 3-30, Table 3-14: In this summary table, the use of percentages to indicate the magnitude of the Rail alternative's impacts exaggerate the actual effects, because the actual numbers involved are quite small (as the comments above have shown).

→ Page 4-1: The Rail alternative has the highest environmental impact and displacements. Also rail is not environmentally benign once it is built and put to use. The energy units (BTUs) to transport one person one mile from the Transportation Energy Data Book: Edition 25-2006 are:

Car	3,549 BTU
Personal Truck	4,008
Transit Bus	4,160
Rail Transit	3,228

Commuting in America III reports that 70% of rail trips in the nation occur in the New York City metro area where subways run full or near-full for extended periods. In all cities with well utilized rail systems, these systems are busy for about four out of 24 hours per day. Unlike cars and personal trucks that spend energy only when they operate, most rail systems run continuously and draw large amounts of energy for serving few riders. Oahu's rail energy consumption will be at least twice as high as the BTUs reported above. Rail is an inferior environmentally and energy dependency alternative for Oahu.

Two critical omissions of the Alternatives Analysis report are information on the cost of the alternatives per resident and taxpayer and the absence of any risk analysis. The latter, for example, is found in any multimillion dollar project involving private funds.

1. Some argue that financial impact analysis should have been done prior to approving the raise of the General Excise Tax from 4.00% to 4.50%. However, at that time the alleged costs were in the order of about two billion dollars with a quarter of that coming from the FTA, leaving the local tax subsidy at $1.5 billion. The AA makes it clear that for the short, 20 mile rail system, the local contribution will be at least $3 billion. A breakdown of this cost per taxpayer and per capita is essential.

2. At a minimum, risk analysis should examine the implications of a partially finished product due to a severe economic downturn or other significant impediments. Travel demand and existing congestion levels dictate that the first useful segment of a future transit system should connect the airport with the Ala Moana Shopping Center. Managed Lanes can serve this (highest demand and congestion) segment because a large part of it is the state DOT's "Nimitz Viaduct" project which has received environmental approvals. However, one cannot operate a rail system without at least one expansive rail yard. The nearest appropriate space for a rail yard identified in the AA is next to the Leeward Community College. Therefore, with any rail alternative, the lowest demand segment must be constructed first, and if conditions do not allow for it, there is the risk of developing an ineffective piece of transit infrastructure connecting LCC to Aloha Stadium.

Appendix 1. Sample Estimations in Person-Hours of Travel

The travel estimates in Table 3-10 tell a different story than the one presented. Conveniently for the rail alternatives, the AA presents "vehicle hours traveled." By using this measure, those who travel on rail conveniently disappear from the travel time calculations as if they travel at warp speed. Far from it.

Let me take the "No Build" and "20-mile Rail" estimates of the AA to demonstrate the amount of time spent for transportation with and without rail using a statistic that truly matters: Person-hours.

The No Build vehicle hours estimate is 395,000 and assuming an average vehicle occupancy of 1.6 people per vehicle (includes buses), then the 2030 estimate is:

No Build Person Hours = 395,000/1.6 = ***246,875*** (1)

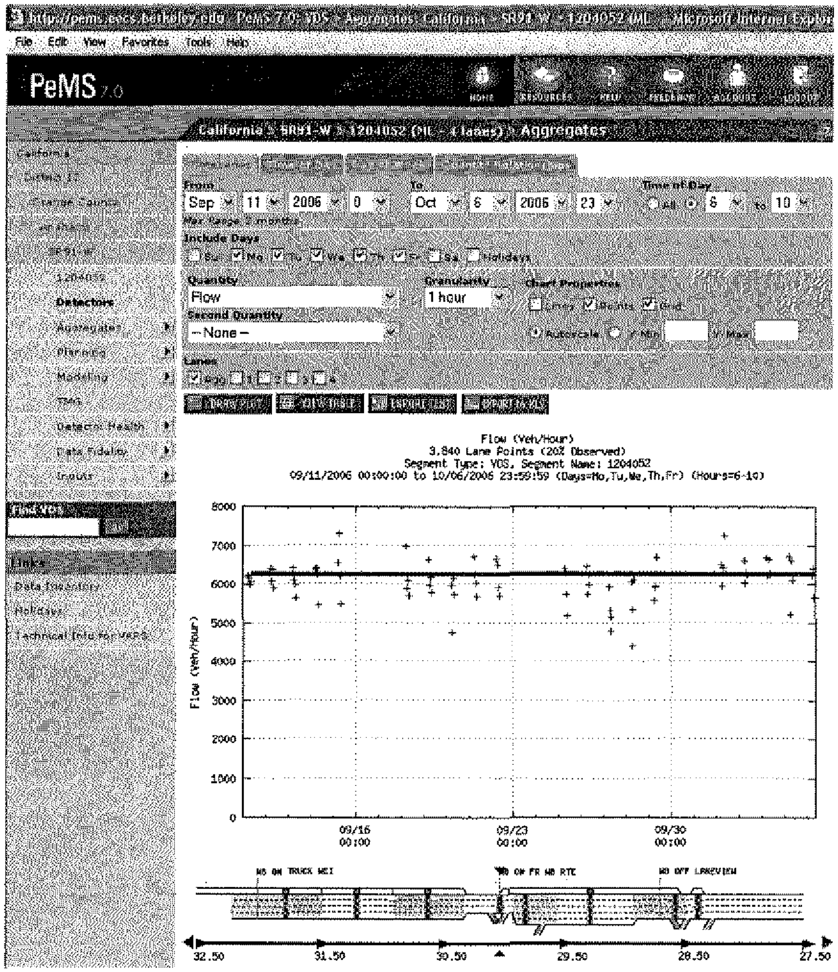
The 20-mile Rail vehicle hours estimate is 376,000 with the same average vehicle occupancy as the No Build. In addition, the 94,970 passengers in Table 3-9 are assumed to travel about half of the available rail line distance, that is, 10 miles on the average, and at the heavy rail average speed of 24 miles per hour. Their person hours of travel are, 94,970 * (10/24) = 39,571. Then the 2030 estimate is:

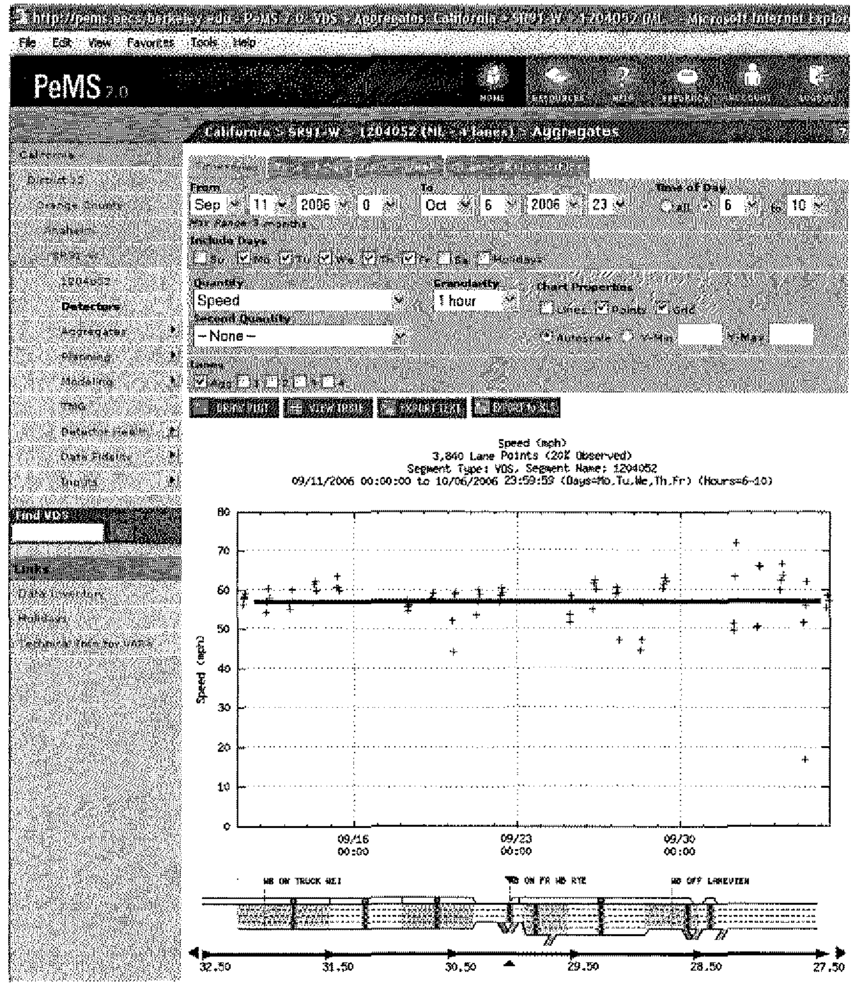
20-mile Rail Person Hours = 376,000/1.6 + 39,571 = ***274,571*** (2)

By comparing (1) and (2) it is clear that the hours spent traveling on Oahu with a 20-mile Rail line will be 11% longer than the No Build. It can be similarly proven that all Rail options will be worse than the No Build.

This outcome is not surprising because, at least in the U.S., the inability of new Rail systems to reduce traffic congestion is well established.

Appendix 2: Real Volume and Speed Operating Characteristics on California SR-91 Express Lanes





Appendix 3.a: Sample Comparisons of AA and Potential Traffic Performance

This set of estimates assumes that vehicular volume for ML is the same as the No Build. This is very conservative because in reality express buses will go from Waikele to Iwilei in 15 minutes.

	2003 Existing	2030 No Build	2030 ML wrong 2 lanes	2030 ML correct 2 lanes	2030 ML correct 3 lanes	2030 Rail (20)
H-1 Fwy	1.15	1.90	1.94	**1.76**	**1.50**	1.81
H-1 Fwy (HOV)	0.84	1.59	1.46	**0.96**	**0.96**	1.44
H-1 Fwy (Zipper)	0.89	1.29	NA	**0.85**	**0.85**	1.18
Moanalua Rd	0.97	0.60	0.57	0.57	0.57	**0.50**
Kamehameha Hwy	0.86	1.01	0.90	**0.90**	**0.90**	**0.89**
Managed Lane	NA	NA	0.79	**0.86**	**0.86**	NA

This set of estimates assumes that express buses will carry the same amount of passengers as the relatively slow and short 20 mile rail option. This is still conservative.

	2003 Existing	2030 No Build	2030 ML wrong 2 lanes	2030 ML correct 2 lanes	2030 ML correct 3 lanes	2030 Rail (20)
H-1 Fwy	1.15	1.90	1.94	**1.55**	**1.29**	1.81
H-1 Fwy (HOV)	0.84	1.59	1.46	**0.96**	**0.96**	1.44
H-1 Fwy (Zipper)	0.89	1.29	NA	**0.85**	**0.85**	1.18
Moanalua Rd	0.97	0.60	0.57	0.57	0.57	**0.50**
Kamehameha Hwy	0.86	1.01	0.90	**0.90**	**0.90**	**0.89**
Managed Lane	NA	NA	0.79	**0.86**	**0.86**	NA

(*) Kalauao Stream Koko Head bound

Highlighted cells show best 2030 V/c ratio -- lower ratio means less congestion.

ML provides the most traffic relief for the AA's highly optimistic 2030 growth rates.

With a 3-lane ML and good express buses, congestion in 2030 will be similar to 2003.

Columns without any highlighted cells contain data exactly as they appear in City's AA.

Engineered to fail: The City added a 2-lane ML and deleted the AM zipper, for a net addition of a single lane! (See Table 3-12.) This is shown above as "ML wrong". "ML correct" has the zipper lane restored.

Appendix 3.b: Detailed Traffic Volume-to-Capacity Rations for a Cross-Section in Aiea

SCREENLINE / FACILITY	Existing Conditions (2003) Facility Capacity (vph)	PB lanes	Observed Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Facility Capacity (vph)	2030 No Build Alternative Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Managed Lane Alternative – Two-direction Option Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koko Head bound												
H-1 Fwy	9500	5	10960	1.15	F	9500	18049	1.90	F	18327	1.93	F
H-1 Fwy (HOV)1	1900	1	1600	0.84	D	1900	3014	1.59	F	2882	1.52	F
H-1 Fwy (Zipper) 1	1900	1	1700	0.89	D	1900	2444	1.29	F	1677	0.88	D
Moanalua Rd	1700		1650	0.97	E	1700	1018	0.60	B	918	0.54	A
Kamehameha Hwy	3450		2960	0.86	D	3450	3498	1.01	F	3226	0.94	E
Managed Lane	4400	0	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D
Total General Purpose Traffic	14650		15570	1.06	F	14650	22565	1.54	F	22471	1.39	F
Total HOV Traffic	3800		3300	0.87	D	3800	5458	1.44	F	4559	1.20	F
Total Managed Lane Traffic	NA	7	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D
		correct					28023			26799		

SCREENLINE / FACILITY	2030 Managed Lane Alternative – Reversible Option Forecast Volume (vph)	DIFF	PB lanes	Volume/ Capacity Ratio	Level of Service	CORRECTED Reversible Option (2 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service	R20 option Forecast Volume (vph)	Volume/ Capacity Ratio	CORRECTED Reversible Option (3 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koko Head bound															
H-1 Fwy	18419	370	5	1.94	F	16695	5	1.76	10% better than PB	17209	1.81	14225	5	1.50	
H-1 Fwy (HOV)1	2769	-245	1	1.46	F	1828	1	0.96	34% better than PB	2740	1.44	1828	1	0.96	
H-1 Fwy (Zipper) 1	NA	0	0	NA	NA	1613	1	0.85	PB mysteriously deleted zippı	2241	1.18	1613	1	0.85	
Moanalua Rd	966	-52		0.57	A	966		0.57	~ Same as PB	853	0.50	966		0.57	
Kamehameha Hwy	3121	-377		0.90	E	3121		0.90	~ Same as PB	3059	0.89	3121		0.90	
Managed Lane	3457	0	2	0.79	C2	3800	2	0.86	~ Same as PB	NA	NA	6270	3	0.86	
Total General Purpose Traffic	22507			1.39	F	20782				21120	1.31	18312			
Total HOV Traffic	2769			1.46	F	3441				4980	1.31	3441			
Total Managed Lane Traffic	3457		8	0.79	C2	3800	9			NA	NA	6270	10		
	28732	wrong, should be 9				28023	correct					28023	correct		

Identical totals – although the reversible ML will carry many more people and a smaller number of vehicles (lower traffic volume)

SCREENLINE / FACILITY	Existing Conditions (2003) Facility Capacity (vph)	PB lanes	Observed Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Facility Capacity (vph)	2030 No Build Alternative Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service	2030 Managed Lane Alternative – Two-direction Option Forecast Volume (vph)	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koke Head bound												
H-1 Fwy	9500	5	10960	1.15	F	9500	18049	1.90	F	18327	1.93	F
H-1 Fwy (HOV)1	1900	1	1600	0.84	D	1900	3014	1.59	F	2882	1.52	F
H-1 Fwy (Zipper) 1	1900	1	1700	0.89	D	1900	2444	1.29	F	1677	0.88	D
Moanalua Rd	1700		1650	0.97	E	1700	1018	0.60	B	918	0.54	A
Kamehameha Hwy	3450		2960	0.86	D	3450	3498	1.01	F	3226	0.94	E
Managed Lane	4400	0	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D
Total General Purpose Traffic	14650		15570	1.06	F	14650	22565	1.54	F	22471	1.39	F
Total HOV Traffic	3800		3300	0.87	D	3800	5458	1.44	F	4559	1.20	F
Total Managed Lane Traffic	NA	7	NA	NA	NA	2200	NA	NA	NA	1769	0.80	D
		correct					28023			28799		

SCREENLINE / FACILITY	2030 Managed Lane Alternative – Reversible Option Forecast Volume (vph)	DIFF	PB lanes	Volume/ Capacity Ratio	Level of Service	CORRECTED Reversible Option (2 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service	R20 option Forecast Volume (vph)	Volume/ Capacity Ratio	CORRECTED Reversible Option (3 lanes) Forecast Volume (vph)	correct lanes	Volume/ Capacity Ratio	Level of Service
Kalauao Stream Koke Head bound															
H-1 Fwy	18419	370	5	1.94	F	14772	5	1.55	10% better than PB	17209	1.81	12302	5	1.29	
H-1 Fwy (HOV)1	2769	-245	1	1.46	F	1828	1	0.96	34% better than PB	2740	1.44	1828	1	0.96	
H-1 Fwy (Zipper) 1	NA	0	0	NA	NA	1613	1	0.85	PB mysteriously deleted zippı	2241	1.18	1613	1	0.85	
Moanalua Rd	966	-52		0.57	A	966		0.57	~ Same as PB	853	0.50	966		0.57	
Kamehameha Hwy	3121	-377		0.90	E	3121		0.90	~ Same as PB	3059	0.89	3121		0.90	
Managed Lane	3457	0	2	0.79	C2	3800	2	0.86	~ Same as PB	NA	NA	6270	3	0.86	
Total General Purpose Traffic	22507			1.39	F	18859				21120	1.31	16389			
Total HOV Traffic	2769			1.46	F	3441				4980	1.31	3441			
Total Managed Lane Traffic	3457		8	0.79	C2	3800	9			NA	NA	6270	10		
	28732	wrong, should be 9				26100	correct			26100.00		26100	correct		

TRANSIT ADVISORY TASK FORCE

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530 S. King Street, Room 202
Honolulu, HI 96819
Phone: (808)523-4139

Report of the Transit Task Force Technical Review Subcommittee
Construction Cost

The purpose of this report is to:

1. Determine if the estimated costs for the construction of the Managed Lane and Fixed Guideway Alternatives in the Alternatives Analysis Report for the Honolulu High-Capacity Transit Corridor Project are reasonable for the purposes of the report, and
2. Compare the estimated cost of the Managed Lane Alternative with the cost for the construction of the high-occupancy toll lanes on the Tampa-Hillsborough County Expressway.

In addition to the Alternatives Analysis Report, information was obtained from:

1. Toru Hamayasu, Department of Transportation Services
2. Clyde Shimizu, Parsons Brinkerhoff Quade and Douglas
3. Martin Stone, Tampa-Hillsborough County Expressway Authority
4. Paul Santo, Highways Division, Hawaii State DOT

Capital costs in the Alternatives Analysis Report for the construction of the Managed Lane Alternative are estimated at $2.6 billion; capital costs of $3.6 billion are projected for the 20-mile Alignment of the Fixed Guideway Alternative. The actual construction cost reported for the Tampa high-occupancy toll lanes was $300 million for construction (including both at-grade and elevated sections), plus $120 million to correct an engineering error in the construction of foundations for some of the support piers.

Both the Managed Lane and the Fixed Guideway Alternatives estimates use the same unit cost prices and cost calculation categories. These standardized cost categories are prescribed by the Federal Transit Administration to facilitate review of project cost information from all projects seeking Federal funding. The unit cost data (cost per cubic yard of concrete, cost per ton of reinforcing steel, etc.) were obtained from the most recent large-scale construction projects on Oahu, such as the construction of the Waimalu section of the H-1 highway viaduct widening, completed last year. DTS' consultants, Parsons Brinckerhoff, also made use of the U.S. Navy's unit cost construction cost data for Hawaii. Labor and other costs from the H-1 Waimalu Viaduct project were also used as inputs for Alternatives cost estimates. The cost per square foot of the Waimalu Viaduct, about $500 per square foot, was considered but not relied on because this work involved widening an existing elevated highway structure, which is known to be more expensive than new construction. The Alternatives Analysis data yield an estimated cost to construct elevated highway structures on Oahu at $330 per square foot, and $390 per square foot in urban areas.

Construction costs for the elevated guideway needed for the Managed Lane Alternative were calculated on the same basis as the construction costs for the guideway structure for the Fixed Guideway Alternative. Both Alternatives are designed to meet AASHTO design standards for elevated highway structures, as was the Tampa tollway. -As previously stated, costs for both Alternatives were calculated using the same per-unit cost elements (for concrete, steel, labor, etc.). Because the elevated structure for the Managed Lane Alternative would be 36 feet wide for its two travel lanes, whereas the structure for the fixed guideway would be only 26 feet wide, different diameter piers are necessary for each (8 feet versus 6 feet in diameter). However, where the managed lanes require only a single lane (e.g., an access/exit ramp), a 6 foot diameter support pier would be used, similar to and costing the same as the piers used for the fixed guideway. The span length between piers is 120 feet for both alternatives' structures. Portions of the structure for the fixed guideway will be significantly taller, 90 feet tall in some places, than the Managed Lane structure.

Capital cost for the Fixed Guideway Alternative would be approximately the same as the guideway cost for the Managed Lane if the following fixed-guideway-specific adjustments were made: (1) Subtract vehicle costs, system infrastructure cost, cost for downtown utilities relocation (the proposed Managed Lane Alternative does not reach downtown, where most utilities relocation costs are incurred); (2) Adjust for construction cost differences (e.g., structure width, different diameter piers); (3) Adjust for the Fixed Guideway Alternative's longer length and increased height.

Alternative lengths of the fixed guideway that could be built to fit budget limitations were addressed with the Department of Transportations Services and its consultant. For instance, $3 billion would build a system from UH at Manoa to Kaahumanu Street on Kamehameha Highway; $3.2 billion dollars would reach Acacia Road at Kamehameha Highway. If the Salt Lake Boulevard alignment were used, $3.2 billion would reach Leeward Community College but would not reach the Navy Drum Storage Area, which is planned for the fixed guideway storage and maintenance yard. An Ala Moana Center to UH link is estimated to cost $540 million and Ala Moana Center to Waikiki link is $490 million. The Department of Transportation Services has not made a detailed analysis of any Minimal Operating Segment (MOS) other than the 20-mile alignment discussed in the Alternatives Analysis.

According to DTS, the Navy Drum Storage site is the site closest to downtown that is feasible for the maintenance/vehicle storage yard, a necessity for a fixed guideway system. DTS reportedly looked at other possible sites, including the former Costco site, and rejected them because they were not large enough, or otherwise unacceptable. The lack of a suitable yard site closer to downtown requires the fixed guideway to extend at least to the Navy Drum Storage site in the Ewa direction, thereby limiting the length of the 20 mile alternative guideway in the Koko Head direction.

The committee suggests that DTS reconsider the use of the Costco site as a maintenance/storage facility, at least on a temporary basis. This would avoid having the guideway end points dictated by the storage yard consideration. If the Costco site is not large enough by itself, perhaps the Federal Department of Defense would consider making available DOD-owned land adjacent to the Costco site, either on a temporary or permanent basis. Alternatively, would a smaller yard be adequate for the first years of fixed guideway operations, perhaps making use of unused running track for vehicle storage and limited vehicle maintenance? We understand that the Miami heavy rail system operated without a storage/maintenance facility for the first year or so after that system opened, and instead made use of available track for off-peak vehicle storage and maintenance.

Testimony before the Task Force has included repeated comparison of the actual cost to construct a three lane partially elevated toll highway in Tampa, Florida versus projected construction costs for necessary for the Managed Lane and Fixed Guideway Alternatives. The following comparison of the costs for the Managed Lane Alternative and the Tampa high-occupancy toll lanes is based on information obtained from the Department of Transportation Services, the Tampa-Hillsborough County Expressway Authority, and the Bridge Section of the Hawaii State Highways Division. The Managed Lane Alternative is 15.8 miles long with two lanes, built entirely on elevated structures. The Tampa high-occupancy toll (HOT) facility is 9.4 miles long, of which 4 miles is at grade, and approximately 5.4 miles is built on elevated structures. The Tampa HOT has three 12-foot lanes with two 10-foot shoulders, and is approximately 59 feet wide and was completed in 2004. The Managed Lane Alternative (assuming reversible lanes – both lanes operating Koko Head direction in the morning rush hour, and both lanes operating Ewa in the evening) is 36 feet wide (two 12-foot lanes, one 10-foot shoulder and one 2-foot shoulder).

Dr. Stone recommended that the proposed Managed Lane Alternative should be widened to three lanes based on the experience of the Tampa Expressway Authority. Further, the lanes should be reversible to gain the advantage of all three lanes in the heavily traveled direction during morning and evening peak hours. He further stated that there were insufficient access/exit ramps in the Honolulu proposal and expressed the opinion that the additional lanes and access/exit ramps would not add substantially to the cost of the project. In his view, he felt the cost estimate in the Alternatives Analysis was far too high.

Paul Santo stated that there is a substantial difference in cost for bridge construction between Hawaii and the mainland US. The State DOT Bridge Section presently uses $400 to $500 per square foot for planning purposes and expects the price will continue to rise and approach $1000 per square foot. By comparison, he said that most highway

agencies on the mainland use $100 to $200 per square foot with some even below $100. He believes the high cost in Hawaii is due to its location and the lack of competition. For instance, there is only one precast concrete plant in Hawaii to produce bridge girders. He understands some general contractors in Hawaii look to shipping girders from the mainland as was done by the contractor for the Ford Island causeway in Pearl Harbor. He further believes the cost for construction of the structures is impacted by the additional cost of utility relocation where the alignment of the facility follows existing rights-of-way, such as the Farrington Highway and Kamehameha Highway corridor for both the Managed Lane and Fixed Guideway Alternatives. In addition, construction costs are higher where work is accomplished within existing highways with high traffic volumes whereas the Tampa HOT lanes were built within an existing median, which appears to be nearly 30 feet wide.
Guideway construction cost estimates developed for the Alternatives Analysis are also high compared to Tampa high-occupancy toll lanes costs because the Alternative Analysis' projected costs include a 30% escalation for "soft costs" (engineering costs) and a 25% escalation on all costs for contingencies. The Tampa HOT cost ($300 million) represents actual construction costs only (including 16% for actual engineering costs), and was for a project that started in 2003. Clyde Shimizu pointed out that the per square foot costs of H-3 viaducts in 1990 ($180) exceeded the Tampa tollway costs incurred only a few years ago.

Since the Tampa tollway was built in the median of the existing expressway, there were no rights-of-way costs incurred. Where the Fixed Guideway or Managed Lane are built within existing State or City rights-of-way, land will be made available for the structures at no cost to the project.

The Tampa high-occupancy toll lanes do not cover capital and operating costs through HOT lanes tolls. Rather, the combined revenues from the expressway and the HOT tollway are used to meet operating and capital costs. Tollway fees are expected to rise from $1 to $1.50 next year. Bonds issued to finance construction of the original expressway, which opened for revenue service in 1975, have now been largely paid off or the debt refinanced, freeing up toll revenue from both the original expressway and the HOT lanes to subsidize the HOT lanes' construction costs.

In conclusion, the cost estimates for the Managed Lane and Fixed Guideways Alternatives in the Alternatives Analysis Report are reasonable. Further, a valid comparison of the costs for the Tampa tollway and the proposed Managed Lane cannot be made without substantial adjustments for differences in construction unit costs.

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Subcommittee Review of the
Honolulu High-Capacity Transit Corridor Project Alternatives Analysis
Chapter 5 – Financial Feasibility Analysis

December 13, 2006

Prepared by Transit Task Force Members:
Randal Ikeda
Cindy McMillan

[Note: the members of this Committee readily acknowledge that they are not financial analysts with experience in the evaluation of financial data for the financing of major capital projects. Except as reported below, they have not been able to recruit outside expertise to assist in a detailed review, given the short time available.]

Objectives

The purpose of our review was to determine the following:

- Does the chapter on financial feasibility (chapter 5) of the Alternative Analysis provide City Councilmembers with the information necessary to select a Locally Preferred Alternative?

Documents Reviewed and Experts Consulted

The following documents were reviewed:

- Honolulu High-Capacity Transit Corridor Project Alternatives Analysis
- Honolulu High-Capacity Transit Corridor Project Alternatives Screening Memorandum (DTS, 2006b)
- Scoping Report, Honolulu High-Capacity Transit Corridor Project (April 6, 2006)

In addition, conversations were held and/or e-mail dialogue was conducted with:

Paul H. Brewbaker, Ph.D
Chair, Council on Revenues
Senior Vice President and Chief Economist, Bank of Hawaii

Jack P. Suyderhoud, Ph.D.
Vice Chair, Council on Revenues
Professor of Business Economics, College of Business Administration, UH – Manoa

David Mieger, AICP
Director of Westside Planning
Los Angeles County Metropolitan Transportation Authority

David Glater
Transit Task Force Analyst

Funding Sources – Fixed Guideway Alternative

1. GET revenue predictions. Because of its central role in the financial plan for the Fixed Guideway alternative, we specifically consulted with experts to determine if the estimated revenues from the General Excise and Use Tax (GET) were reasonable. The methodology described below was reviewed by Jack P. Suyderhoud, Ph.D. who indicated that the estimates made in the Alternatives Analysis seem to be reasonable, with the caveats that there is always some inherent uncertainty in forecasting and that the greatest uncertainty in this case is how the new tax will affect reporting of non-Oahu transactions.

   Specifically, from the Honolulu Advertiser, Sunday, Dec. 10, 2006 "while the tax increase in the statewide excise tax only applies to O'ahu, the state has ruled that all companies selling products here — even those based on the Neighbor Islands — will have to pay the tax. So will O'ahu-based companies doing business primarily on the Neighbor Islands". DTS's consultant developed a 17% discount to Oahu's current percentage of the tax base in order to account for the historical over-reporting of Oahu based transactions. That discount factor is based on the primary assumption that the tax base percentage by island will equal the "de facto" population percentage by island. (Population estimates are provided by the State Department of Business, Economic Development and Tourism. The de facto population is defined as the number of persons physically present in an area, regardless of military status or usual place of residence. It includes visitors present but excludes residents temporarily absent. Oahu has 67% of the State's de facto population.) While this is a reasonable assumption, there is still no absolute way to predict actual tax reporting behavior.

   Process that DTS' consultant used to develop GET Surcharge Revenue Projections:

   1. Estimate of the State's overall tax base using historical patterns;

   2. Estimate of what proportion of the State's 4% tax base is attributable to Oahu. Ans. 81% based on historical patterns;

   3. Develop an additional adjustment to reflect businesses that are headquartered in Oahu, but that report some economic activity outside of the county, which income is therefore not subject to the tax surcharge; base assumption is that the percentage of the tax base by island, is equal to the percentage of population by island; therefore the current tax base percentage for Oahu is overstated by 81% - 67% = 14%; pro-rating the 14% over the Oahu current tax base percentage, results in the discount of 14% divided by 81% (14%/81%) = 17%;

   4. Apply 0.5% to the adjusted base; then subtract 10% for the State's administrative costs;

   5. Apply growth rates using the following three scenarios:

      a. Extrapolation of historical patterns (1990 – 2005) to 2022;
      b. Council on Revenue forecast growth rates to 2013 and then reversion to historical growth to 2022; or

c. Council on Revenue forecast growth to 2013 and continuation of that growth to 2022.

6. Present each revenue forecast with and without inflation.

2. Federal contribution to the Fixed Guideway alternative. The Alternatives Analysis assumes an FTA New Starts contribution of $933-948 million. Alternatives Analysis, tables 5-7, 5-8, p. 5-12. The FTA's share of the cost of a New Starts project has generally not exceeded $750 million, with limited exceptions -- primarily for grants made to projects in the New York-New Jersey metropolitan area. When FTA does make a grant exceeding $750 million, the following statement is regularly included in the project description submitted to Congress: "FTA notes that MTA's [New York City's Metropolitan Transit Authority] New Starts funding request is higher than what has historically been provided to other major transit capital projects, but ...." (Text following the "but": "...the New Starts share of 26% is significantly lower than most other projects."). FTA New Starts Report to Congress, FY 2006, p. 15. (Some exceptions to this $750 million informal ceiling outside of the New York area: Los Angeles reportedly divided a single project into three "minimally operable segments" ("MOS"), and then separately applied for and obtained $650 million in New Starts funding for each MOS; Washington, DC Metro extension through Dulles corridor (MOS #1) -- $920 million applied for (50% of costs). It should be noted that the amount Honolulu is seeking is 20-25% of total costs (depends on the funding actually obtained from the GET ½% surcharge). This percentage represents a smaller share of total project cost than FTA usually provides, and is comparable to the 26% contribution cited by FTA to support its grant to New York in excess of the usual ($750 million) amount.

   DTS Administration reports that FTA staff at both the regional and headquarters level has encouraged the City to aim high, and ask for what it reasonably needs. If the Full Corridor Alignment were selected by the Council as the Locally Preferred Alternative, could the project be broken into minimally operable segments as LA and Washington, DC have done, in order to keep the cost of the initial MOS phase under $3.2 billion, while maximizing Honolulu's New Starts Funding over the life of the entire project? Again assuming that the Full Corridor Alignment were selected, could a route alignment for sections 3, 4 and 5 be selected that would be less costly to build than the Alternatives Analysis' preferred alignment for these sections? For example, based on Table 5-2 of the Alternatives Analysis, what would be the impact of selecting the lower cost alignment of Salt Lake Boulevard – North King Street – Queen Street instead of the AA's preferred alignment for sections 3, 4 & 5? Would this lower cost alignment permit a MOS costing $3.2 billion (or less) and permit construction of an alignment beginning at the UH Manoa campus and extending at least to the Navy Drum Storage site – the proposed maintenance-vehicle storage yard? If so, how would this lower-cost alignment compare to the benefits for the AA's recommended alignment, and how would it be evaluated under the FTA's New Starts evaluation criteria?

3. Sharing the benefit of increased value of real property adjacent to fixed guideway facilities. The Alternative Analysis cites various means whereby the City could share in gains from property appreciation (tax increment financing; benefit assessment districts – see p. 5-9), however the report does not quantify the dollar potential of these revenue-producing value capture tools. Based on conversations with Paul Brewbaker, Ph.D., Chairman of the Council on Revenues, there will be

significant increases in the property values along the rail alignment. What mechanisms will the City put in place to use that increased value to help subsidize the construction and operation of the rail system? And what will the City do to discourage speculation on the rail alignment real estate to minimize land acquisition and development costs?

Funding Sources – Managed Lane Alternative

1. Is there a possibility of receiving New Starts funding for the Managed Lane Alternative?

   The Alternatives Analysis concludes that Federal New Starts funds would not be available for the Managed Lane Alternative "because of use by toll-paying single-occupancy vehicles, which are excluded from the statutory definition of 'fixed guideway' (49 USC Section 5302)." AA, p. 5 – 6. Would New Starts funds be available for this alternative if single-occupancy vehicles were prohibited from using the facilities? In other words, would New Starts funding be available if the managed lane facility were restricted to transit vehicles and high-occupancy toll-paying vehicles? If so, how much New Starts funding would be available for this alternative and would that significantly affect its financial feasibility or alter its status relative to the other alternatives? Would this be an unacceptable change in the Managed Lanes concept as proposed?

2. Managed Lanes toll revenue.

   The Alternatives Analysis states that the Managed Lanes – Reversible Option peak period toll would be $6.40 (2006 dollars) in 2030. How was that price determined? Would the demand be sufficiently inelastic to allow collection of higher tolls? Alternatively, if this toll exceeds what prospective West Oahu users can reasonably afford, these users may chose not to use the facility. In this circumstance, opening the facility to single-occupancy vehicles makes less sense. If these speculations have merit, this alternative could be redefined to exclude single-occupant vehicles, and to operate as an HOV lane. Although FTA is reportedly no longer funding HOV lanes under the New Starts program (because it considers these to be highway projects more appropriately financed by Highway Trust Funds), there be some operational mode that will meet FTA's eligibility criteria for New Starts funding and also satisfy Managed Lanes proponents.

Conclusion

Based on our review and research, we believe Chapter 5 – Financial Feasibility Analysis is based on reasonable assumptions and sound methodology. In general, there is adequate information for the Council to make "an intelligent selection of a preferred mode and general alignment."

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Appendix 2

Discussion-piece #6
Predicted and Actual Ridership of Proposed New Starts Projects
Federal Transit Administration
June 6, 2006

Purposes of ridership reviews. FTA periodically compares the actual ridership against the ridership predictions for major transit projects using Federal "New Starts" funds. The analysis has three purposes: (1) to provide an up-to-date picture on the reliability of ridership forecasts as the basis for decision-making on proposed New Starts projects; (2) to identify any needed improvements in the technical methods used to make the forecasts; and (3) to identify any appropriate modifications to the way that FTA uses New Starts forecasts in project evaluation.

Pickrell report. FTA published the initial review in 1990 in the report *Urban Rail Transit Projects: Forecast Versus Actual Ridership and Cost* (commonly referred to as the Pickrell report after its primary author). That review considered ten projects and found that only one project generated actual ridership that was more than 50 percent of the predicted ridership (specifically, 72 percent) Actual ridership for the other nine projects was less than 50 percent of their forecasts.

2003 report. FTA prepared (but has not yet released) the 2003 report *Predicted and Actual Impacts of New Starts Projects: Capital Cost, Operating Cost and Ridership Data* (hereafter termed the Phase-1 report) to consider the 19 New Starts projects (both rail and bus guideways) that opened for revenue service since the 1990 report. The post-1990 projects showed improvements in the quality of forecasts. Four of the 19 projects generated ridership that was between 70 and 80 percent of their forecasts. Another three projects generated ridership between 80 and 100 percent of their forecasts. And three projects had actual ridership that exceeded their forecasts by modest amounts. Table 1 summarizes the 19 projects, their ridership forecasts, and their actual (or extrapolated) ridership in the forecast year.

Pickrell update. The 2003 report also included an updated (year 2000) look at the ten projects reviewed by Pickrell. Two of those ten projects had year-2000 ridership close to forecast levels; two others showed growth since the 1990 report but were still far below forecast levels; three projects had little change in ridership; and three experienced declines in ridership since 1990.

Phase-1 conclusions. The 2003 report suggested several possible reasons for the improved quality of transit forecasts post-Pickrell, including greater forecasting experience, more formalized forecasting procedures and guidelines, increased scrutiny of forecasts and the planning process by government agencies and the public, improved forecasting technical methods, and improved computing technology. The report also observed forecasts for people movers, busways, and starter rail lines tended to be least reliable while forecasts for system expansions (additional lines in new corridors or extensions of existing lines in the same corridor) were relatively more reliable.

Phase-2. In 2006, further FTA-sponsored analysis of completed projects concluded in the draft report *Predicted and Actual Ridership of New Starts Projects: Detailed Analysis* (not yet released; hereafter the Phase-2 report) undertook detailed reviews of the ridership forecasts for seven of the nineteen Phase-1 projects (as identified in Table 1). This work faced a substantial hurdle in the general unavailability of detailed information on the forecasts themselves. The forecasts were prepared 10 to 20 years ago and supporting documents and data sets (zone-level demographics, trip tables, zone definitions, and coded transit and highway networks) were simply not available. The case studies included two "successful" forecasts that were within ±20 percent of actual ridership and five "less successful" forecasts that were more than twice the actual ridership.

Successful forecasts. The two projects with successful forecasts – San Diego El Cajon and Portland Westside – were expansions of existing light rail systems. While it was extremely difficult in a retrospective analysis to confirm the level of quality control and reasonableness checks during the forecasting process, a review of both the calibration and validation tests and the results, as well as transit paths and skims, suggests that these procedures have been more rigorously followed in areas with successful forecasts. To some extent, the success of the two forecasts was the product of offsetting errors. While both forecasts were within ±20 percent of actual project-specific ridership, both missed actual levels of systemwide ridership more than ±20 percent and relied upon corridor-level demographic forecasts that also varied from actual outcomes by more than +/- 20 percent.

Less-successful forecasts. The five less-successful forecasts appear to have been subject to multiple types of errors of varying magnitude. Sources of error included erroneous model inputs, problematic model properties, and mistakes in model application – and all forecasts were subject to more than one of these errors.

- Input errors. The most frequent error involved the magnitude and location of future population and employment growth, a problem in all seven of the case studies, contributing both to the less successful forecasts and the offsetting errors that may have masked other problems in the successful forecasts. Because transit relies heavily on walking for access/egress, errors in demographic forecasts at the regional and/or corridor levels are compounded by incorrect allocations to zones within walking distances of fixed-guideway stations. Other sources of input error include the representation of future-year transportation networks (both highway and transit), inadequate detail in the zone system used to represent the region, as well as prices for transit fares, gasoline, and parking. At least one (and usually more) of these input errors specifically contributed to the forecasting error in each of the "less successful" case studies.

- Model-property errors. A common problem in the less-successful forecasts was the overestimation of future highway congestion. This problem may be the result of problematic demographic forecasts filtering through the model chain. However, overestimation of highway congestion appeared to occur even where regional trip tables generally replicated actual travel patterns indicated by census journey-to-work information and household surveys. In such cases the culprit is the model set itself, likely problems time-of-day distributions and/or network assignment.

- Model-application errors. Haste in the completion of forecasts to support funding application or environmental documents appears to have led to improper representation of changes in project scope or transit service plans in the travel forecasts. Other changes in scope and service plans have occurred after the forecasts were completed, without a corresponding update in the forecasts. In at least one case the model was validated to an outdated set of observed data before being used for the transit forecasts.

Absence of detailed records. While some insights were available from the seven case studies, by far the most significant outcome of the Phase-2 effort was the clear finding that useful comparisons of forecasts with actual outcome are not possible with the largely non-existent records of the forecasts. This outcome has significant implications for the usefulness of the Before-and-After studies that are now a required element of New Starts projects that receive Full Funding Grant Agreements and suggests the need to formalize the preservation of forecasts so that meaningful reviews of their accuracy are possible.

Table 1: Predicted and Actual Ridership for Phase-1 Projects - Forecast Year Comparison

Project	Forecast Year	Forecast Avg Weekday Boardings		Actual (projected) Boardings in Forecast Year	Ratio - Forecast yr actual/Forecast	
		AA/DEIS	FEIS		Actual vs. AA/DEIS	Actual vs. FEIS
Jacksonville ASE	1995	42,472	42,472	2,627(1)	6%	6%
Miami Omni/Brickell	2000	20,404	20,404	4,209	21%	21%
Houston SW Transitway *	2005	27,280	27,280	9,066	33%	33%
Atlanta North Line *	2005	57,120	57,120	21,595	38%	38%
LA Red Line *	2000	295,721	297,733	128,659(1)	44%	43%
Pittsburgh West B'Way	2005	23,369	23,369	10,200(3)	44%	44%
Chicago Orange Line *	2000	118,760	118,760	54,042	46%	46%
San Jose Guadalupe	1990	41,200	41,200	19,738(2)	48%	48%
San Jose Tasman West *	2005	14,875	13,845	9,110	61%	66%
Baltimore LRT Ext.	2005	11,804	12,230	8,207	70%	67%
Baltimore Johns Hopkins	2005	13,600	13,600	10,049	74%	74%
Portland Westside-Hillsboro *	1995/2005	60,314	49,448	49,999	83%	101%
Dallas South Oak Cliff	2005	34,170	34,170	29,307	86%	86%
BART Colma	2000	15,200	15,200	13,482	89%	89%
Salt Lake South LRT	2010	26,500	23,000	25,201	95%	110%
St. Louis Initial System	1995	41,800	37,100	43,711(4)	105%	118%
San Diego El Cajon *	2000	21,600	21,600	23,478	109%	109%
Denver SW LRT	2015	22,000	22,000	23,988(5)	109%	109%
St. Louis St. Clair Ext.	2010	11,960	20,274	16,965	142%	84%
Denver I-25 HOV	2000	not stated	not stated	8,853	NA	NA
Seattle Bus Tunnel	1990	not stated	not stated	44,400	NA	NA

(1) Actual boardings in forecast year given for 2001 since this is the first full year of operation.

(2) Actual boardings in forecast year given for 1992 since this is the first full year after opening

(3) Actual boardings are assumed to increase 1,200 daily riders over 2002 as an additional park and ride lot is completed.

(4) Actual boardings given for 1999 since Airport station did not open until 1998. Forecast year boardings reached by applying the average annual growth in transit boardings achieved by the project sponsor between 1990 and 2002.

(5) Denver has experienced relatively fast ridership growth over the past decade. Since the forecast year remains far in the future, continued growth at recent trends appears overly ambitious. FTA assumed that the Denver project will achieve a growth rate 2/3rds of the growth rate observed between 1990 and 2002. Even at this lower assumed growth rate, this project is very likely to exceed its AA/DEIS forecasts by a significant margin.

* Selected for detailed analysis in the Phase-2 study.

Table 2. Predicted and Actual Ridership for Phase II Case Studies: Summary of Findings by Project

City/Project Name	Summary of Findings
Atlanta MARTA North Line Extension	• 2005 observed boardings only 40% of forecast boardings • Observed rail system ridership less than forecast • Observed overall transit ridership close to forecast but widely fluctuates year-to-year • Forecasting error caused by failure to achieve predicted employment levels in station areas in primary travel market, underestimation of regional employment, fluctuations in overall system ridership, inaccurate transit coding conventions in the model, poor trip distribution model, over-reliance on mode choice adjustment factors, and validation to outdated observed data set.
Chicago CTA Orange Line	• 2000 observed project boardings only 46% of forecast boardings • Observed system-wide rail boardings close to forecast • Observed transit system boardings close to forecast • Forecasting error caused by failure to account for demographic changes in study area / corridor, and poor model structure, especially for trip distribution and mode choice
Houston METRO Southwest Transitway	• 2005 projected (from 2002 observed) boardings only 33% of forecast boardings • Observed transit system ridership less than forecast • Forecasting error caused by failure to achieve predicted population and employment levels in the study corridor and region, failure to achieve predicted land uses in station areas, overestimation of future highway congestion, poor transit coding and zone system, and changes to project following completion of forecasts
Los Angeles MTA Red Line	• 2001 (1st year of full line operation) observed boardings 43% of (2000) forecast boardings • Observed transit system boardings 72% of forecast boardings • Forecasting error caused by poor model inputs for transit fares, gasoline costs, fuel economy, poor transit-access coding, failure to achieve employment forecasts, failure to fully restructure background bus network to eliminate direct competition with line and provide feeder service, service changes due to conversion from trunk line to trunk/branch operations, relocation of line to less attractive transit corridor, and length of time needed to construct and operate full line
Portland Tri-Met Westside/ Hillsboro LRT	• 2002 observed boardings 8% over 2005 predicted boardings • 2001 observed LRT system boardings 3% over 2005 predicted boardings • Forecasting success caused by realistic and quality-controlled transit service inputs, previous experience operating LRT, higher than forecast population/employment growth • Approximately 10% to 15% of the success may be attributed to underestimation of growth • Good model features, such as extra trip purposes, cars per worker variable, use of choice models for demographic inputs, inclusion of non-mechanized trips in mode choice, good model accounting of transit accessibility and use of mode-of-access model in mode choice may have contributed to forecasting success • Errors in population and employment forecasts may have helped ridership forecast for project but are indicative of larger errors in the demographic and employment model (offsetting errors)
San Diego MTDB El Cajon LRT	• 2000 observed boardings 9% over 2000 predicted boardings • 2000 observed LRT system boardings 57% over 2000 predicted boardings • 2000 observed transit system boardings 2% over 2000 predicted boardings • Forecasting success caused by realistic model inputs and quality control, good model features, and greater than expected population and employment growth in the corridor • Approximately 15% to 20% of the success may be attributed to underestimation of growth • Errors in population and employment forecasts may have helped ridership forecast for project but are indicative of larger errors in the demographic and employment model (offsetting errors) • Large forecasting error for LRT system overall suggests problems with mode choice model
San Jose VTA Tasman West LRT	• 2005 observed boardings only 25% of 2005 predicted boardings • Forecasting error caused by severe economic contraction in corridor and surrounding region, overestimation of highway congestion, poor TAZ system, unrefined trip distribution model, poor network inputs, and poor transit assignment

Available at: www.fta.dot.gov/planning/newstarts/planning_environment_5402.html

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Appendix 3

Suggestions for further development of the Managed Lane Alternative.

- The Alternatives Analysis' description of the characteristics of the Managed Lane Alternative should provide more complete information as to mass transit operations utilizing this facility. The Alternatives Analysis states that new express and other bus transit routes would be developed for operation on the Managed Lane facility. (p. 2-4) A fuller development and presentation of the transit services that would accompany the Managed Lane Alternative would be helpful (e.g., routes, new/existing stations). There is no description in the Alternatives Analysis of any proposed supportive operational practices off of the Managed Lane facility that would complement the facility's use as a transit guideway, e.g., transit stations connected to park-and-ride facilities, reserved lanes for transit vehicles on existing streets, traffic signal priority for transit vehicles.

- In its discussion of travel time benefits of the Managed Lane options, the Alternatives Analysis projects that traffic congestion at both the H-1 Freeway access to the Managed Lane facility and at the Nimitz Highway exit at Pacific Street will negate travel time benefits gained from travel on the Managed Lane facility itself. The Analysis should explore how traffic congestion at these points could be alleviated (at least for mass transit vehicles) in order to enhance the overall performance of this Alternative as a transit guideway.

- The description of the Managed Lane Alternative in Chapter 2 of the Alternatives Analysis states "The H-1 zipper lane would be maintained in the Two-direction Option but discontinued in the Reversible Option." (p. 2-4). However, no explanation is provided as to why the zipper lane would not be continued in the Reversible Option. The Managed Lane Reversible Option's addition of two Koko Head-bound elevated lanes for the morning commute appears to result in a net increase of only one lane if the inbound zipper lane were removed.

- The foldout photographic plans presenting the Managed Lane Alternative (Alternatives Analysis, Figures 2 -- 1 and 2 -- 2) do not clearly depict the ramp lanes necessary to access the Managed Lane facility from Interstate Highways H-1 and H-2 in both the Two-direction Option and the Reversible Option, or the ramp lanes necessary to exit from the facility to these Interstate Highways.

- These plans show an approximately one-mile long "facility" in the vicinity of Kaonohi Street (Figure 2 -- 1), and another in the vicinity of Radford Drive (Figure 2 -- 2), however no description of these facilities is provided. In discussions with DTS Administration staff, these facilities have been identified as transit stations with attendant deceleration and acceleration lanes. Assuming this to be the case, it would be helpful to see the proposed location(s) of park-and-ride facilities planned near these stations, comparable to the information presented in Table 3 -- 5, with respect to the Fixed Guideway Alternative. It is not apparent whether the stations would operate in both the Two-direction Option and the Reversible Option. What are the cost implications of adding access/exit ramps for transit vehicles instead of building elevated transit stations?

- Figure 2 -- 2 shows a small section of the Managed Lane facility approximately 2000 feet Koko Head of the end of the facility at Nimitz Highway/Pacific Street. This component of the Managed Lane facility is not explained. Is it an elevated structure or at-grade? Which Managed Lane users would be allowed to access it?

- Figure 2 -- 1 shows two ramps in the vicinity of Aloha Stadium. It is not clear whether these ramps would be available in both the Two-direction Option and the Reversible Option, or whether these ramps would be available to other than transit vehicles (e.g., to vans, three-person and two-person automobiles, and/or single-occupant automobiles paying tolls).

See also Financing Committee's report discussing changes in permitted access to the Managed Lane facility that might make the facility eligible for New Starts and/or GET ½% surcharge funds.

TRANSIT ADVISORY TASK FORCE

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Appendix 4

Questions the Task Force posed to DTS Administration, and the answers received:

1. From the local press, there appears to be a willingness to spend 3.2 -- 3.6 billion dollars for a fixed guideway system, and considerable discomfort spending more than that. Can you calculate how much $3 billion (or $3.2 billion) would buy toward a system with the following alignments:

a) Beginning at UH-Manoa and running Ewa using the optimal alignment described in Chapter 6 of the Alternatives Analysis Report.

b) same question, but using the Salt Lake Blvd alignment instead of the Aolele Street alignment in Section 3, Aloha Stadium to Middle Street.

Answer to 1(a). $3.0 billion will reach Kaahumanu St. on Kamehameha Hwy from UH at Manoa. $3.2 billion will reach Acacia Rd at Kamehameha Hwy. Both will be short of reaching the yard site in the Navy Drum Storage.
Answer to 1(b): $3.2 billion will reach Leeward Community College via Salt Lake Blvd. It will not reach the Navy Drum Storage site.

2. What are the capital costs for the fixed guideway link between Ala Moana Center and the University -Manoa? Link between Ala Moana and Waikiki?
Answer: Ala Moana Center to UH link is estimated to be $540 million. Ala Moana Center to Waikiki is $490 million.

3. Has DTS analyzed any Minimal Operating Segment (MOS) other than the 20-mile alignment?
Answer: no.

4. How do the construction standards for the guideway for the Managed Lane Alternative (Alternative 3) differ from the standards applicable to construction of the guideway for the Fixed Guideway Alternative (Alternative 4)? Do construction costs for these two guideways differ?
[The response to this question is summarized in the report submitted by construction committee.]

5. Has the DTS analyzed the Managed Lane Alternative operated so as to qualify for FTA New Starts funding (no single-occupant vehicles)?
Answer (paraphrased): the Managed Lane Alternative is based on a proposal submitted by a member of the public approximately 1 year ago, in response to invitations to the public to come up with alternatives to a fixed guideway system. The primary differences are that the DTS Managed Lane Alternative now includes an off ramp at the stadium, and a station near Middle Street. If the Managed Lane Alternative excluded single-occupant vehicles, it would qualify as a HOV lane, however, FTA is no longer funding HOV lanes under the New Starts program because it considers these to be highway projects eligible for Highway Trust Funds.

6. How much would $3.2 billion buy toward a fixed guideway system that would begin at the Ala Moana Shopping Ctr. and then travel Ewa along the Administration's preferred alternative to Liliha St./Kaaahi St., then travel farther Ewa along N. King St., then (at Middle St.) travel Ewa along Moanalua Freeway to Salt Lake Blvd., then along Salt Lake Blvd. to the Kamehameha Highway to Farrington Highway to Kamokila Blvd. to Kapolei. (This route appears to be straighter and shorter than the "optimum" alignment specified in Ch. 6 of the Alternatives Analysis.)
[No answer received as yet]

7. What is the cost of a fixed guideway system that followed the above Koko Head – Ewa route alignment, but that stopped Ewa at Palehua Road?
[No answer received as yet]

8. The Alternatives Analysis identifies two possible sites for a maintenance/repair yard for use with a fixed guideway system: one on the north side of Farrington Hwy., opp. the DRHorton Development site, and an alternative on the south side of Farrington Hwy. just south of H-1 ["Navy Drum site"]. Have you identified any other sites that could be used for this purpose that are Koko Head of these two alternatives? If yes, what evaluation of these other sites have you done?
Answer: We looked at many possible sites during this project, including revisiting some sites that were considered in the past studies. We reviewed all possible open or underused sites between 15 to 20 acres. They included all parks and recreational facilities (e.g. Diamond Head, Ala Wai Golf Course, Thomas Square) and they were eliminated from further considerations. Some industrial use sites such as Sand Island, Keehi Lagoon, and Shafter Flat were evaluated and eliminated for various reasons; Sand Island – off line, Keehi – unsuitable soil condition, Shafter – Federal land. Other sites such as Alapai, Middle St., former Costco, and Block J are too small. UH Manoa Quarry and other public school sites were looked but did not pursue. Bottom line – nothing suitable east of the Navy Drum site.